GRADY

Design of the Steel Framework Of an Office Building

Civil Engineering

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DESIGN OF THE STEEL FRAMEWORK OF AN OFFICE BUILDING

BY

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THESIS

FOR THE

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IN

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THIS IS TO CERTIFY THAT THE THESIS PREPARED UNDER MY SUPERVISION BY

PAUL L GRADY

ENTITLED DESIGN OF THE STEEL FRAMEWORK OF AN OFFICE BUILDING

IS APPROVED BY ME AS FULFILLING THIS PART OF THE REQUIREMENTS FOR THE

DEGREE OF Bachelor of Science in Civil Engineering

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INTRODUCTION.

The steel frame "sky scraper" is a natural out growth resulting from conditions imposed upon the owners of property lying within the business sections of our large cities.

The advantages to the larger cities, as to time and convenience in business transactions, to have all possible office buildings and commercial interests concentrated within certain limited areas, has also proved an important factor in the introduction of high buildings. In New York and Chicago, where the steel "sky scrapers" had their birth, these limitations were caused by the topographical features of the down-town sections, and the only means of increasing the limited business areas were by the introduction of higher buildings.

The erection of high buildings with a greatly increased floor space therefore became a necessity, not only to accomodate the rapid growth of trade interests, but as a business proposition for the improvement of the real estate. Increased floor areas became a necessity to insure a proper return on the investment, and with the high and ever increasing values of real estate in the centers of such limited business areas, the natural vertical extension of floor upon floor has constantly increased in the endeavor to make investment in such buildings a safe and profitable business adventure.

GENERAL SPECIFICATIONS.

The following general specifications have been adopted for the design of proposed office building to be located at Champaign,

Illinois.

The building is to be eight stories in height, the floors to be spaced 11 feet from floor surface to floor surface. Each floor is to contain at least 5000 square feet of clear floor surface, permitting the spacing of partitions to suit tenant The building is to be constructed of steel and brick, forming a type of construction commonly known as the veneered type, each spandrel wall to be carried independently of the others. The spandrel walls are to be faced with terra cotta brick.

A cornice is to be constructed at about the level of the roof and is to extend entirely along the sides of the building, which front upon the streets, and for a distance of fifteen feet into the alley. This is to project over the street at least 3 1/2 and not over 5 feet.

The building is to occupy a rectangular corner lot 75x90 feet, and along the street fronts is to be paralleled by a 16-foot sidewalk.

Ketchum's general specifications for steel mill buildings, revised as noted, and the building laws of the city of Chicago govern the design of the building.

Ketchum's specifications are revised as follows:

Art.--29 Changed to read

$S = 17100 - 57\, l/r$ where

l = length in inches

r = least radius of gyration.

Art.--33 E as used here is 30,000,000 instead of 28,000,000.

Art.--36 Shear in rivets shall not exceed 12000 pounds, nor bearing in plates 24000 pounds per square inch.

Art.--66 Minimum size angle to be used is 3x2 1/2x1/4 inches instead of 2x2x1/4 inches.

Art.--74 The ratio l/r governing the length of main compression members is changed from 125 to 150.

GENERAL DESCRIPTION.

The floor framing plans of this building, shown in Plate-2, give the general dimensions and arrangement of the building.

The building is to be eight stories high, the floors being spaced 11 feet apart, and the roof 15 feet above the eighth floor. Suspended from the roof is a ceiling, leaving an air space of four feet between it and the roof. The spandrel walls along the street front, from the ground to the lintels of the eighth floor windows, are one foot thick and are set in reveal, being 4 1/2 inches back of the face of the piers, which are flush with the building line. From these, lintels to the base of the cornice the spandrel walls are built flush with the faces of the piers. A cornice at about the level of the roof projects 4 feet over the street. This extends entirely along the sides of the building, which front upon the streets, and extends 15 feet into the alley. Where the spandrel walls do not face either street, they do not carry a cornice and are built in reveal for their entire height.

The window space in each panel is 7 feet high and extends from a line 8 inches on either side of the pier.

The elevators are placed in the corridor about midway between the fronting streets, three 6x6 1/2 foot passenger elevators being provided. The stair-well, in which is hung an iron fireproof stairs, is placed to one side of the elevators leaving between them a 7 1/2 foot shaft for carrying pipe, counter weights, etc.

The floors are composed of 6-inch reinforced concrete slabs, which are built around the floor beams making a monolithic fireproof construction. The slabs are covered with 4 inches of cinder concrete, in which are imbedded nailing strips for the maple flooring.

The main partitions are built of 4-inch blocks of tile and are placed directly over the floor and tie beams. The intermediate or movable partitions are built of 2 inch blocks of tile, and may be placed at the convenience of the tenant.

CALCULATION OF LOADS UPON FLOOR SLABS.

The floor slabs are designed for a dead load equal to the exact weight of the floor slab, and a live load of 40 pounds for the roof, 70 pounds for a typical floor and 150 pounds for the first floor.

LOADS ON ROOF.

Dead load.		
4 1/2 inch concrete slab	per sq. ft.	60 pounds
Tar roofing--------------	per sq. ft.	5 pounds
Live load--------------------	per sq. ft.	40 pounds
	Total per sq. ft.	105 pounds

LOADS ON TYPICAL FLOOR

Dead load.		
6-inch concrete slab	per sq. ft.	75 pounds
4 inches cinder concrete	per sq. ft.	22 pounds
Maple flooring	per sq. ft.	3 pounds
Live load-----------	per sq. ft.	70 pounds
	Total per sq. ft.	170 pounds

LOADS ON FIRST FLOOR.

Dead load.		
6-inch concrete slab	per sq. ft.	75 pounds
4 inches cinder concrete	per sq. ft.	22 pounds
Maple flooring-----------	per sq. ft.	3 pounds
Live load--------------------	per sq. ft.	150
	Total per sq. ft.	250 pounds

D E S I G N O F F L O O R S L A B S .

In all floor slabs the reinforcement is such that the span is 15 feet, the slab being designed as a continuous beam one foot wide and 15 feet long

DESIGN OF ROOF SLAB.

The total load carried by a beam 1 foot wide over 1 span is 105x15= 1575 pounds

M= 1/10 Wl.= 1/10x1575x15x12= 28400 in. lbs.

From the tables prepared by the St.Louis Expanded Metal Company from tests made at their laboratory, the resisting moment of a 4 1/2-inch concrete slab reinforced by 1/2 inch corrugated steel bars 5 inches apart and 3/4 inches from the lower side of the beam, is 142000 inch pounds.

Factor of Safety= 142000/28400= 4.85

DESIGN OF TYPICAL FLOOR SLAB.

W= 15x170= 2550 pounds

M= 1/10x2550x15x12= 45900 inch pounds.

From the tables explained above, the resisting moment of a 6-inch slab reinforced by 1/2 inch square corrugated bars 3 1/2 inches apart and 3/4 inches from the lower side, is 284000 inch-pounds.

Factor of Safety= 284000/45900= 6.17

DESIGN OF FIRST FLOOR SLAB.

W= 250x15= 3750.pounds.

M= 1/10x3750x15x12= 67500 inch pounds.

By using the above slab whose resisting moment is 284000 inch-pounds, the factor of safty is 284000/67500= 4.15.

CALCULATION OF LOADS UPON FLOOR AND SPANDREL BEAMS

In considering the loads upon the floor beams, it is assumed that, since the floor slab acts as a beam in the direction of the reinforcement, the reaction is entirely taken up by the beams perpendicular to the steel bars, the beams parallel to the reinforcement merely being tie beams. In the previous article it was stated that the floor slab acted as a beam 15 feet long; hence each interior floor beam supports a surface 15 feet wide and whose length is that of the beam. In the end floor beams the surface is only 7 1/2 feet wide.

In designing the floor beams for the roof, typical floor and first floor, in each case the total dead load coming on the beam was considered, and in the case of the roof beams a total live load of 40 pounds per square foot was taken as acting on the beam; but in designing the beams for the typical floor and first floor, only 85% of the live loads, 70 and 150 pounds, respectively per square foot, was assumed as acting.

In figuring the spandrel beams the brick work was taken at 120 pounds per cubic foot, and the window space at 5 pounds per square foot of area. All brick work below the lintels of the eighth floor windows was taken as 13 inches thick and that above, at 18 inches. From the side elevation of a typical spandrel wall shown in Plate 2 the uniform load per linear foot upon the spandrel beam can easily be computed.

D E S I G N   O F   S P A N D R E L   A N D   F L O O R   B E A M S

I beams are used in all cases for the spandrel and floor beams. The moment of the loads upon the beam was found and the beam was then designed using the formula $M = S\ I/c$, S being taken as 16000 pounds. (Cambria hand book used.) All spandrel beams are covered by a plate 1 inch less in width than the wall and 3/8 inches thick. This is so riveted to the beam that the wall will project over it at each side 1/2 inch.

In designing the connection of the spandrel and floor beams to the columns and girders, 7/8 inch rivets are used and designed as field rivets.

D E S I G N   O F   R O O F   G I R D E R S .

Girder	Uniform load per foot	Total load	M	I/c	Section from Cambria	No. 7/8" rivets in conn.
1-2	200+750	14300	321000	20.1	10"-25#-I	3
2-3	" "	"	"	"	" " "	3
3-4	" "	"	"	"	" " "	3
4-5	" "	"	"	"	" " "	3
5-6	" "	"	"	"	" " "	3
1-12	200	3000	68000	4.25	6"-12 1/4#-I	2
12-13	"	"	"	"	" " "	2
13-22	"	"	"	"	" " "	2
22-23	"	"	"	"	" " "	2
23-30	"	"	"	"	" " "	2
30-31	"	"	"	"	" " "	2
31-32	200+750	14300	321000	20.1	10"-25#-I	3
32-33	" "	"	"	"	" " "	3
33-34	" "	19000	428000	26.8	10"-30#-I	3
12-11	1500	22500	507000	31.7	12"-31 1/2#-I	4
13-14	"	"	"	"	" " "	4
21-22	"	"	"	"	" " "	4
23-24	"	"	"	"	" " "	4
30-29	"	"	"	"	" " "	4
11-10	"	"	"	"	" " "	4
14-15	"	"	"	"	" " "	4
21-20	"	"	"	"	" " "	4
24-25	"	"	"	"	" " "	4

Girder	Uniform load per foot	Total load	M	I/c	Section from Cambria	No. 7/8" rivets in conn.
29-28	1500	22500	507000	31.7	12"-31 1/2#-I	4
10-9	"	"	"	"	" " "	4
9-8	"	"	"	"	" " "	4
8-7	"	"	"	"	" " "	4
15-16	"	30000	900000	56.3	15"-42#-I	5
16-17	200+750	9500	212000	12.7	10"-25#-I	3
17-18	" "	14300	321000	20.1	" " "	3
20-19	1500		772400	48.3	15"-42#-I	5
25-26	1500		644800	40.3	" " "	5
28-27	"		772400	48.3	" " "	5
6-7	200	3000	68000	4.25	6"-12 1/4#-I	2
7-18	"	"	"	"	" " "	2
16-19	"	"	"	"	" " "	2
19-26	"	"	"	"	" " "	2
26-27	"	"	"	"	" " "	2
27-34	"	"	"	"	" " "	2

Use 6"-12 1/4#-I beams for ties with two rivets in connection.

D E S I G N   O F   G I R D E R S

To carry spandrel wall between 8th. floor and roof.

Girder	Uniform load per foot	Total load	M	I/c	Section from Cambria	No. 7/8" rivets in conn.
1-2	720	10800	243000	15.2	9"-21#-I	2
2-3	"	"	"	"	" " "	2
3-4	"	"	"	"	" " "	2
4-5	"	"	"	"	" " "	2
5-6	"	"	"	"	" " "	2
6-7	500	7500	169000	10.6	8"-18#-I	2
12-1	720	10800	243000	15.2	9"-21#-I	2
7-18	500	7500	169000	10.6	8"-18#-I	2
18-17	"	"	"	"	" " "	2
17-16	"	5000	112500	7.1	" " "	2
16-19	"	7500	169000	10.6	" " "	2
19-26	"	"	"	"	" " "	2
26-27	"	"	"	"	" " "	2
27-34	"	"	"	"	" " "	2
34-33	"	10000	225000	14.1	" " "	2
33-32	"	7500	169000	10.6	" " "	2
32-31	720	10800	243000	15.2	9"-21#-I	2
31-30	"	"	"	"	" " "	2
30-23	"	"	"	"	" " "	2
23-22	"	"	"	"	" " "	2
22-13	"	"	"	"	" " "	2
13-12	"	"	"	"	" " "	2

D E S I G N   O F   T Y P I C A L   F L O O R   G I R D E R S .

Girder	Uniform load per foot	Total load	M	I/c	Section from Cambria	No. 7/8" rivets in conn.
1-2	587+1240	27400	5163000	32.3	12"-31 1/2#-I	4
2-3	" "	"	"	"	" " "	4
3-4	" "	"	"	"	" " "	4
4-5	" "	"	"	"	" " "	4
5-6	" "	"	"	"	" " "	4
1-12	587	7800	175500	11.0	8"-18#-I	2
12-13	"	"	"	"	" "	2
13-22	"	"	"	"	" "	2
22-23	"	"	"	"	" "	2
23-30	"	"	"	"	" "	2
30-31	"	"	"	"	" "	2
31-32	587+1240	27400	516000	32.3	12"-31 1/2#-I	4
32-33	" "	"	"	"	" " "	4
33-34	" "	36540	822500	51.5	15"-42#-I	6
12-11	2480	37100	836000	52.3	" "	6
13-14	"	"	"	"	" "	6
22-21	"	"	"	"	" "	6
23-24	"	"	"	"	" "	6
30-29	"	"	"	"	" "	6
11-10	"	"	"	"	" "	6
14-15	"	"	"	"	" "	6
21-20	"	"	"	"	" "	6
24-25	"	"	"	"	" "	6

Girder	Uniform load per foot	Total load	M	I/c	Section from Cambria	No. 7/8" rivets in conn.
29-28	2480	37100	836000	52.3	15"-42#-I	6
10-9	"	"	"	"	" " "	6
9-8	"	"	"	"	" " "	6
8-7	"	"	"	"	" " "	6
15-16	"	49600	1115000	69.7	18"-55#-I	7
16-17	587+1240	18200	410000	25.6	15"-42#-I	6
17-18	" "	27400	616000	38.6	" " "	6
20-19	2480	49600	1115000	69.7	18"-55#-I	7
25-26	"	"	"	"	" " "	7
28-27	"	"	"	"	" " "	7
6-7	1320	19800	445000	27.8	12"-31 1/2#-I	4
7-18	"	"	"	"	" " "	4
16-19	587	7800	175500	11.0	8"-18#-I	2
19-26	"	"	"	"	" " "	2
26-27	"	"	"	"	" " "	2
27-34	"	"	"	"	" " "	2

Use 6"-12 1/4#-I beams for ties with two rivets in connection.

DESIGN OF FIRST FLOOR GIRDERS.

Girder	Uniform load per foot	Total load	M	I/c	Section from Cambria	No. 7/8" rivets in conn.
1-2	587+1742	34850	660000	41.3	15"-42#-I	5
2-3	" "	"	"	"	" " "	5
3-4	" "	"	"	"	" " "	5
4-5	" "	"	"	"	" " "	5
5-6	" "	"	"	"	" " "	5
1-12	587	7800	175500	11.0	8"-18#-I	2
12-13	"	"	"	"	" " "	2
13-22	"	"	"	"	" " "	2
22-23	"	"	"	"	" " "	2
23-30	"	"	"	"	" " "	2
30-31	"	"	"	"	" " "	2
31-32	587+1742	34950	660000	41.3	15"-42#-I	5
32-33	" "	"	"	"	" " "	5
33-34	" "	46600	1162000	66.4	18"-55#-I	6
12-11	3486	52250	984000	61.5	15"-50#-I	5
13-14	"	"	"	"	" " "	5
22-21	"	"	"	"	" " "	5
23-24	"	"	"	"	" " "	5
30-29	"	"	"	"	" " "	5
11-10	"	"	"	"	" " "	5
14-15	"	"	"	"	" " "	5
21-20	"	"	"	"	" " "	5
24-25	"	"	"	"	" " "	5

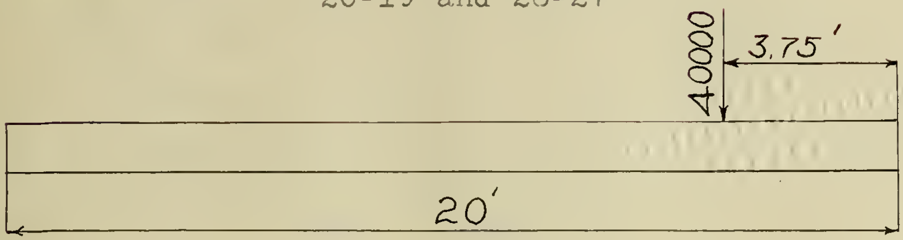
Girder	Uniform load per foot	Total load	M	I/c	Section from Cambria	No. 7/8" rivets in conn.
29-28	3486	15250	984000	61.5	15"-50#-I	6
10-9	"	"	"	"	" " "	6
9-8	"	"	"	"	" " "	6
8-7	"	"	"	"	" " "	6
15-16	"	69720	1305000	81.5	18"-55#-I	7
16-17	587+1743	23300	437000	27.3	15"-42#-I	6
17-18	" "	34950	660000	41.3	" " "	6
20-19	3486	69720	1305000	81.5	18"-55#-I	7
25-26	"	"	"	"	" " "	7
28-27	"	"	"	"	" " "	7
6-7	1320	19800	445000	27.8	12"-31 1/2#-I	4
7-18	"	"	"	"	" " "	4
16-19	587	7800	175500	11.0	8"-18#-I	2
19-26	"	"	"	"	" " "	2
26-27	"	"	"	"	" " "	2
27-34	"	"	"	"	" " "	2

Use 6"-12 1/4#-I beams for ties with two rivets in connection.

D E S I G N   O F   B E A M S   W I T H   C O N N E C T I O N S   T O   C A R R Y   E L E V A T O R S .

END BEAMS.

20-19 and 28-27



R= 40000/20x3.75= 7500 pounds

M= 7500x16.25x12= 1465000 inch-pounds.

i/c= 1465000/16000= 91.7

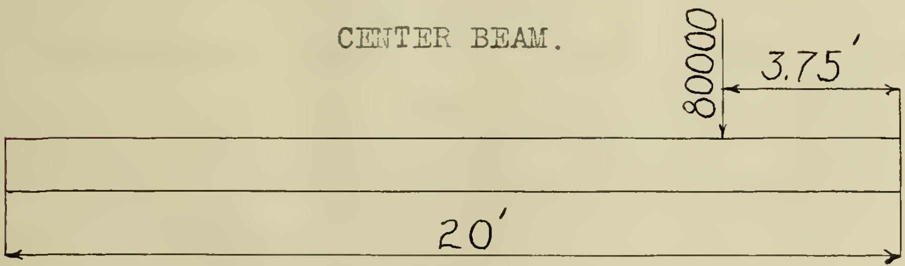
From Cambria I/c of 18"-60#-I= 95.5.

Columns 19 and 27 are composed of 5/16 inch steel.

Allowable bearing of a 7/8 inch rivet= 4376 pounds.

40000-7500/4376= 8- number of field rivets required.

CENTER BEAM.



M= 2930000 in. lbs. I/c= 2930000/16000= 183.4

i/c of a 24"-90#-I= 186.5

Allowable bearing in 5/8 inch plate= 13125 pounds.

Allowable shear of 7/8 inch rivet= 7220 pounds

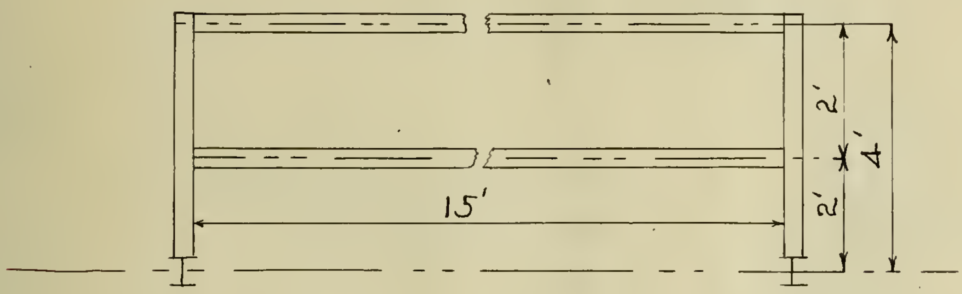
80000-15000/13125= 5- number of rivets required in bearing.

65000/7220= 9- number of rivets required in shear.

DESIGN OF CORNICE FRAMING.

The cornice is composed of heavy terra-cotta blocks firmly fastened to the framing by means of steel rods. These blocks are hollow, and are filled with a brick concrete whose weight is 100 pounds per cubic foot. The cornice as a whole is taken as 2 1/2 cubic feet, or 250 pounds per linear foot. A section through the framing is shown in Plate 1.

In the design of the cornice framing, a system of cantilevers were projected from the columns and connected by beams.



The assumption was made, in finding the bending moments of the cantilever beams, that the cantilevers supported but 1/2 of the total load the other half being transmitted directly to the roof girders and columns.

M= S I/c= 15x250/2x3x12= 67500 inch pounds

I/c= 67500/16000= 4.3

I/c of a 6"-13# of a channel beam= 5.8

The longitudinal beams were designed for a uniform load of 62 1/2 pounds per linear foot.

M= 15x62 1/2x7 1/2x12= 84300 inch-pounds.

I/c= 83400/16000= 5.27   I/c-6"-13# channel= 5.8

2-7/8" field rivets will be used in all the connections.

L O A D S   O N   C O L U M N S .

The column load schedules, which are shown on the pages immediately following, were figured for the following loading.

Dead Load.

Spandrel walls.

Brick work	120 #	per cubic foot.
Window space	5 #	per square foot.

Cornice	250 #	per linear foot.

Roof

4 1/2" concrete slab	60 #	per	square	foot.
Tar roofing	5 #	"	"	"
Steel	5 #	"	"	"

Typical and first floors.

6" concrete slab	75 #	per	square	foot
4" cinder concrete	22 #	"	"	"
Maple flooring	3 #	"	"	"
Steel	5 #	"	"	"

Live load.

The roof was figured for a live load of 40 pounds per square foot, and the top floor for 85% of 70 pounds per square foot. This was then reduced 5% per floor until the first floor was reached, that being figured at 50% of 150 pounds per square foot.

SCHEDULE OF COLUMN LOADS

TABLE I

Columns- 2-3-4-5-17 and 32

Floor	Classification of Loads	Load		
		Concen	Eccen	On Footing
Roof	Cornice		3750	
	Spandrel Wall			
	Dead Load	6750		
	Live Load	4500		
	Total	11250	3750	15000
8th	Floor Above	15000		
	Spandrel wall	13500		
	Dead Load			
	Live Load			
	Total	28500		28500
7th	Floor Above	28500		
	Spandrel wall	10000		
	Dead Load	11800		
	Live Load	6700		
	Total	57000		57000
6th	Floor Above	57000		
	Spandrel wall	10000		
	Dead Load	11800		
	Live Load	6300		
	Total	85100		85100
5th	Floor Above	85100		
	Spandrel wall	10000		
	Dead Load	11800		
	Live Load	5900		
	Total	112800		112800
4th	Floor Above	112800		
	Spandrel wall	10000		
	Dead Load	11800		
	Live Load	5500		
	Total	140100		140100
3rd	Floor Above	140100		
	Spandrel Wall	10000		
	Dead Load	11800		
	Live Load	5125		
	Total	167025		167025
2nd	Floor Above	167025		
	Spandrel wall	10000		
	Dead Load	11800		
	Live Load	4725		
	Total	193550		193550
1st	Floor Above	193550		
	Spandrel wall	10000		
	Dead Load	18000		
	Live Load	4325		
	Total	219675		219675
Basement	Floor Above	219675		
	Spandrel Wall	10000		
	Dead Load	11800		
	Live Load	14350		
	Side Walk	48000		
	Total	303825		303825

SCHEDULE OF COLUMN LOADS

TABLE II

Columns - 12 - 13 - 22 - 23 - 30

Floor	Classification of Loads.	Load: Concen	Load: Eccen.	Load: On Footing.
Roof	Cornice	3750		
	Dead Load	3750	3000	
	Live Load		4500	
	Total	7500	7500	15000
8th	Floor Above	15000		
	Spandrel Wall	13500		
	Dead Load			
	Live Load			
	Total	28500		28500
7th	Floor Above	28500		
	Spandrel Wall	10000		
	Dead Load		11800	
	Live Load		6700	
	Total	38500	18500	57000
6th	Floor Above	57000		
	Spandrel Wall	10000		
	Dead Load		11800	
	Live Load		6300	
	Total	67000	18100	85100
5th	Floor Above	85100		
	Spandrel Wall	10000		
	Dead Load		11800	
	Live Load		5900	
	Total	95100	17700	112800
4th	Floor Above	112800		
	Spandrel Wall	10000		
	Dead Load		11800	
	Live Load		5500	
	Total	122800	17300	140100
3rd	Floor Above	140100		
	Spandrel Wall	10000		
	Dead Load		11800	
	Live Load		5125	
	Total	150100	16925	167025
2nd	Floor Above	167025		
	Spandrel Wall	10000		
	Dead Load		11800	
	Live Load		4725	
	Total	177025	16525	193550
1st	Floor Above	193550		
	Spandrel Wall	10000		
	Dead Load		11800	
	Live Load		4325	
	Total	203550	16125	219675
Basement	Floor Above	219675		
	Spandrel Wall	10000		
	Dead Load		11800	
	Live Load		14350	
	Side-walk	48000		
	Total.	277675	26150	303825

Schedule of Column Loads

Table III

Columns-8-9-10-11-14-21-24-29.

Floor	Classification of Loads.	Load Concen.	Eccen.	On Footing.
Roof and 8^{th}	Dead Load Live Load Total.	18000 9300 27300		27300
7^{th}	Floor Above Dead Load Live Load Total	27300 23900 13400 64600		64600
6^{th}	Floor Above Dead Load Live Load Total	64600 24100 12600 101300		101300
5^{th}	Floor Above Dead Load Live Load Total	101300 24300 11800 137400		137400
4^{th}	Floor Above Dead Load Live Load Total	137400 24300 11000 172400		172400
3^{rd}	Floor Above Dead Load Live Load Total	172400 24400 10200 207400		207400
2^{nd}	Floor Above Dead Load Live Load Total	207400 24500 9400 241300		241300
1^{st}	Floor Above Dead Load Live Load Total	241300 24600 8700 274600		274600
Basement	Floor Above Dead Load Live Load Total	274600 24740 16800 316140		316140

Schedule of Column Loads.

Table IV.

Column - 7.

Floor	Classification of Loads.	Load: Concen.	Eccen.	On Footing.
Roof	Dead Load	1800	6750	
	Live Load		4500	
	Total	1800	11250	13050
8th	Floor Above	13050		
	Spandrel Wall	8800		
	Dead Load			
	Live Load			
	Total	21850		21850
7th	Floor Above	21850		
	Spandrel Wall	14200		
	Dead Load		11800	
	Live Load		6700	
	Total	36050	18500	54500
6th	Floor Above	54500		
	Spandrel Wall	14200		
	Dead Load		11800	
	Live Load		6300	
	Total	68700	18100	86850
5th	Floor Above	86850		
	Spandrel Wall	14200		
	Dead Load		11800	
	Live Load		5900	
	Total	101050	17700	118750
4th	Floor Above	118750		
	Spandrel Wall	14200		
	Dead Load		11800	
	Live Load		5500	
	Total	132950	17300	150250
3rd	Floor Above	150250		
	Spandrel Wall	14200		
	Dead Load		11800	
	Live Load		5125	
	Total	164450	16925	181575
2nd	Floor Above	181375		
	Spandrel Wall	14200		
	Dead Load		11800	
	Live Load		4725	
	Total	195575	16525	212100
1st	Floor Above	212100		
	Spandrel Wall	14200		
	Dead Load		11800	
	Live Load		4325	
	Total	226300	16125	242425
Basement	Floor Above	242425		
	Spandrel Wall	14200		
	Dead Load		11800	
	Live Load		14350	
	Total	256625	26150	282775

SCHEDULE OF COLUMN LOADS

TABLE V.

Column - 16

Floor	Classification of Loads.	Load: Concen	Load: Eccen.	Load: On Footing.
Roof	Spandrel Wall Dead Load Live Load Total	600 11250 7500 19350	900 900	 20250
8th	Floor Above Spandrel Wall Dead Load Live Load Total	20250 2400 24650	 3600 3600	 26250
7th	Floor Above Spandrel Wall Dead Load Live Load Total	26250 8000 19700 11150 65100	 4000 4000	 69100
6th	Floor Above Spandrel Wall Dead Load Live Load Total	69100 8000 19700 10500 107300	 4000 4000	 111300
5th	Floor Above Spandrel Wall Dead Load Live Load Total	111300 8000 19700 9850 148850	 4000 4000	 152850
4th	Floor Above Spandrel Wall Dead Load Live Load Total	152850 8000 19700 9150 189700	 4000 4000	 193700
3rd	Floor Above Spandrel Wall Dead Load Live Load Total	193700 8000 19700 8550 229950	 4000 4000	 233950
2nd	Floor Above Spandrel Wall Dead Load Live Load Total	233950 8000 19700 7850 269500	 4000 4000	 273500
1st	Floor Above Spandrel Wall Dead Load Live Load Total	273500 8000 19700 7200 308400	 4000 4000	 312400
Basement	Floor Above Spandrel Wall Dead Load Live Load Total.	312400 8000 19700 14000 354100	4000 4000	 358100

SCHEDULE OF COLUMN LOADS

TABLE VI.

Columns - 19 and 20

Floor	Classification of Loads	Load: Concen	Load: Eccen	Load: On Footing.
Roof	Dead Load	1800	36050	
	Live Load		2350	
	Total	1800	38400	40200
8th	Floor Above	40200		
	Dead Load		3500	
	Live Load		6100	
	Spandrel Wall	10000		
	Total	50200	9600	59800
7th	Floor Above	59800		
	Spandrel Wall	10000		
	Dead Load		6100	
	Live Live		3300	
	Total	69800	9400	79200
6th	Floor Above	79200		
	Spandrel Wall	10000		
	Dead Load		6100	
	Live Load		3100	
	Total	89200	9200	98400
5th	Floor Above	98400		
	Spandrel Wall	10000		
	Dead Load		6100	
	Live Load		2875	
	Total	108400	8975	117375
4th	Floor Above	117375		
	Spandrel Wall	10000		
	Dead Load		6100	
	Live Load		2675	
	Total	127375	8775	136150
3rd	Floor Above	136150		
	Spandrel Wall	10000		
	Dead Load		6100	
	Live Load		2450	
	Total	146150	8550	154700
2nd	Floor Above	154700		
	Spandrel Wall	10000		
	Dead Load		6100	
	Live Load		2250	
	Total	164700	8350	173050
1st	Floor Above	173050		
	Spandrel Wall	10000		
	Dead Load		6100	
	Live Load		2050	
	Total	183050	8150	191200
Basement	Floor Above	191200		
	Spandrel Wall	10000		
	Dead Load		6100	
	Live Load		7500	
	Total	201200	13600	214800

Schedule of Column Loads.

TABLE VII.

Column- 26

Floor	Classification of Loads	Load. Concen	Eccen.	on Footing.
Roof	Dead Load	1800	68550	
	Live Load		2350	
	Total	1800	70900	72700
8th	Floor Above	72700		
	Spandrel Wall	10000		
	Dead Load		6100	
	Live Load		3500	
	Total	82700	9600	91400
7th	Floor Above	91400		
	Spandrel Wall	10000		
	Dead Load		6100	
	Live Load		3300	
	Total	101400	9400	110800
6th	Floor Above	110800		
	Spandrel Wall	10000		
	Dead Load		6100	
	Live Load		3100	
	Total	120800	9200	130000
5th	Floor Above	130000		
	Spandrel Wall	10000		
	Dead Load		6100	
	Live Load		2875	
	Total	140000	8975	148975
4th	Floor Above	148975		
	Spandrel Wall	10000		
	Dead Load		6100	
	Live Load		2675	
	Total	158975	8775	167750
3rd	Floor Above	167750		
	Spandrel Wall	10000		
	Dead Load		6100	
	Live Load		2450	
	Total	177750	8550	186300
2nd	Floor Above	186300		
	Spandrel Wall	10000		
	Dead Load		6100	
	Live Load		2250	
	Total	196300	8350	204650
1st	Floor Above	204650		
	Spandrel Wall	10000		
	Dead Load		6100	
	Live Load		2050	
	Total	214650	8150	222800
Basement	Floor Above	222800		
	Spandrel Wall	10000		
	Dead Load		6100	
	Live Load		7500	
	Total	232800	13600	246400

SCHEDULE OF COLUMN LOADS.

TABLE VIII.

Floor	Classification of Loads.	Load: Concen	Load: Eccen	Load: On Footing.
Roof	Spandrel Wall			
	Dead Load	7875		
	Live Load	5250		
	Total	13125		13125
8th	Floor Above	13125		
	Spandrel Wall	10320		
	Dead Load			
	Live Load			
	Total	23445		23445
7th	Floor Above	23445		
	Spandrel Wall	10600		
	Dead Load	13800		
	Live Load	7800		
	Total	57645		57645
6th	Floor Above	57645		
	Spandrel Wall	10600		
	Dead Load	13800		
	Live Load	7350		
	Total	89400		89400
5th	Floor Above	89400		
	Spandrel Wall	10600		
	Dead Load	13800		
	Live Load	6900		
	Total	120700		120700
4th	Floor Above	120700		
	Spandrel Wall	10600		
	Dead Load	13800		
	Live Load	6450		
	Total	151550		151550
3rd	Floor Above	151550		
	Spandrel Wall	10600		
	Dead Load	13800		
	Live Load	6000		
	Total	181950		181950
2nd	Floor Above	181950		
	Spandrel Wall	10600		
	Dead Load	13800		
	Live Load	5500		
	Total	211850		211850
1st	Floor Above	211850		
	Spandrel Wall	10600		
	Dead Load	13800		
	Live Load	5050		
	Total	241300		241300
Basement	Floor Above	241300		
	Spandrel Wall	10600		
	Dead Load	13800		
	Live Load	16700		
	Total.	282400		282400

Schedule of Column Loads

TABLE IX.

Column - 25

Floor	Classification of Loads.	Load Concen	Load Eccen	Load On Footing
Roof and 8th	Elevators Dead Load Live Load Total	12700 13500 9000 35200		35200
7th	Floor Above Dead Load Live Load Total	35200 24300 14010 73510		73510
6th	Floor Above Dead Load Live Load Total	73510 24300 12980 110790		110790
5th	Floor Above Dead Load Live Load Total	110790 24300 12150 147240		147240
4th	Floor Above Dead Load Live Load Total	147240 24300 11320 182860		182860
3rd	Floor Above Dead Load Live Load Total	182860 24300 10540 217700		217700
2nd	Floor Above Dead Load Live Load Total	217700 24300 9760 251760		251760
1st	Floor Above Dead Load Live Load Total	251760 24300 8930 284990		284990
Basement	Floor Above Dead Load Live Load Total	284990 24300 17350 326650		326650

Schedule of Column Loads.

TABLE X.

Columns- 20 and 28

Floor	Classification of Loads	Load. Concen.	Eccen	On Footing.
Roof and 8th	Dead Load + Elevators Live Load Total	22775 10260 33035		33035
7th	Floor Above Spandrel Wall Dead Load Live Load Total	33035 26900 15275 75200		75200
6th	Floor Above Dead Load Live Load Total.	75200 26900 14360 116460		116460
5th	Floor Above Dead Load Live Load Total	116460 26900 13450 156800		156800
4th	Floor Above Dead Load Live Load Total	156800 26900 12540 196240		196240
3rd	Floor Above Dead Load Live Load Total	196240 26900 11640 234800		234800
2nd	Floor Above Dead Load Live Load Total	234800 26900 10720 272420		272420
1st	Floor Above Dead Load Live Load Total	272420 26900 9910 309230		309230
Basement	Floor Above Dead Load Live Load Total.	309230 26900 20820 356950		356950

-K-

Schedule of Column Loads

Table XI.

Columns 1 and 31.

Floor	Classification of Loads	Load: Concen	Load: Eccen	Load: On Footing
Roof	Cornice	1900	1900	
	Spandrel Wall	1400	900	
	Dead Load	3400		
	Live Load	2250		
	Total	8950	2800	11750
8th	Floor Above	11750		
	Spandrel Wall	7300	5400	
	Dead Load			
	Live Load			
	Total	19050	5400	24450
7th	Floor Above	24450		
	Spandrel Wall	5000	5000	
	Dead Load	5900		
	Live Load	3350		
	Total	38700	5000	43700
6th	Floor Above	43700		
	Spandrel Wall	5000	5000	
	Dead Load	5900		
	Live Load	3150		
	Total	57750	5000	62750
5th	Floor Above	62750		
	Spandrel Wall	5000	5000	
	Dead Load	5900		
	Live Load	2950		
	Total	76600	5000	81600
4th	Floor Above	81600		
	Spandrel Wall	5000	5000	
	Dead Load	5900		
	Live Load	2750		100250
	Total	95250	5000	
3rd	Floor Above	100250		
	Spandrel Wall	5000	5000	
	Dead Load	5900		
	Live Load	2550		
	Total	113700	5000	118700
2nd	Floor Above	118700		
	Spandrel Wall	5000	5000	
	Dead Load	5900		
	Live Load	2400		
	Total	132000	5000	137000
1st	Floor Above	137000		
	Spandrel Wall	5000	5000	
	Dead Load	5900		
	Live Load	2200		
	Total	150100	5000	155100
Basement	Floor Above	155100		
	Spandrel Wall	5000	5000	
	Dead Load	5900		
	Live Load	7200		
	Side-Walk	75200	24000	
	Total	248400	29000	277400

Schedule of Column Loads.

TABLE XII.

Columns-6 and 18

Floor	Classification of Loads.	Load. Concen	Eccen	On Footing
Roof	Cornice	900	1000	
	Spandrel Wall	1400		
	Dead Load	3400		
	Live Load	2250		
	Total	7950	1000	8950
8th	Floor Above	8950		
	Spandrel Wall	7300	3600	
	Dead Load			
	Live Load			
	Total	16250	3600	19850
7th	Floor Above	19850		
	Spandrel Wall	5000	7100	
	Dead Load	5900		
	Live Load	3350		
	Total	34100	7100	41200
6th	Floor Above	41200		
	Spandrel Wall	5000	7100	
	Dead Load	5900		
	Live Load	3150		
	Total	55250	7100	62350
5th	Floor Above	62350		
	Spandrel Wall	5000	7100	
	Dead Load	5900		
	Live Load	2950		
	Total	76200	7100	83300
4th	Floor Above	83300		
	Spandrel Wall	5000	7100	
	Dead Load	5900		
	Live Load	2750		
	Total	96950	7100	104050
3rd	Floor Above	104050		
	Spandrel Wall	5000	7100	
	Dead Load	5900		
	Live Load	2550		
	Total	117500	7100	124600
2nd	Floor Above	124600		
	Spandrel Wall	5000	7100	
	Dead Load	5900		
	Live Load	2400		
	Total	137900	7100	145000
1st	Floor Above	145000		
	Spandrel Wall	5000	7100	
	Dead Load	5900		
	Live Load	2200		
	Total	158100	7100	165200
Basement	Floor Above	165200		
	Spandrel Wall	5000	7100	
	Dead Load	5900		
	Live Load	7200		
	Total	183300	7100	190400

SCHEDULE OF COLUMN LOADS.

TABLE XIII.

Column ---- 34

Floor	Classification of Loads.	Load: Concen	Load: Eccen	Load: On Footing
Roof	Spandrel Wall	1200	900	
	Dead Load	4500		
	Live Load	3000		
	Total	8700	900	9600
8th	Floor Above	9600		
	Dead Load			
	Spandrel Wall	5300	3600	
	Live Load			
	Total	14900	3600	18500
7th	Floor Above	18500		
	Spandrel Wall	6050	4000	
	Dead Load	7900		
	Live Load	4150		
	Total	36600	4000	40600
6th	Floor Above	40600		
	Spandrel Wall	6050	4000	
	Dead Load	7900		
	Live Load	3950		
	Total	58500	4000	62600
5th	Floor Above	62500		
	Spandrel Wall	6050	4000	
	Dead Load	7900		
	Live Load	3700		
	Total	80200	4000	84200
4th	Floor Above	84200		
	Spandrel Wall	6050	4000	
	Dead Load	7900		
	Live Load	3400		
	Total	101550	4000	105550
3rd	Floor Above	105550		
	Spandrel Wall	6050	4000	
	Dead Load	7900		
	Live Load	3200		
	Total	122700	4000	126700
2nd	Floor Above	126700		
	Spandrel Wall	6050	4000	
	Dead Load	7900		
	Live Load	2950		
	Total	143600	4000	147600
1st	Floor Above	147600		
	Spandrel Wall	6050	4000	
	Dead Load	7900		
	Live Load	2600		
	Total	164150	4000	168150
Basement	Floor Above	168150		
	Spandrel Wall	6050	4000	
	Dead Load	7900		
	Live Load	9500		
	Total	191600	4000	195600

DESIGN OF COLUMNS.

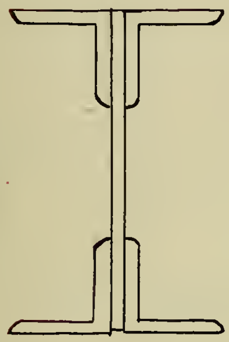
The columns as designed were divided into two different classes, namely: Those in which all the loads were concentric, and those which were in part loaded eccentrically. All loads which were transferred from the column of one floor to the column of the floor below were treated as concentric loads. An example of the method of designing each class of columns will be given.

The column schedule which follows gives in general the results of the computations. However, these are not the exact results obtained in the design as given by the examples, the sections having been so arranged that the columns project through two floors and break joints.

EXAMPLES OF METHODS OF DESIGNING COLUMNS

LOAD CONCENTRIC COLUMN-25

Roof and Eighth Floor.



$S = 35000^{\#}$

$l = 15'\text{-}0'' = 180''$

Assume $3'' \times 2\frac{1}{2}'' \times \frac{1}{4}''$ Ls and $6'' \times \frac{1}{4}''$ Pl.

$A = 6.79 \quad r = 1.24$

Allowable $S = 17100 - 57 \times \frac{180}{1.24}$

$= 8830^{\#}/\square''$

$S = \frac{35000}{6.79} = 5180$

$E = \frac{8830}{5180} = 169.5\%$

Seventh Floor.

$S = 73510^{\#}$

Assume section as above $\quad l = 11'\text{-}0'' = 132''$

Al. $S = 17100 - 57 \times \frac{132}{1.24} = 11030^{\#}/\square$

$S = \frac{73510}{6.79} = 10850^{\#}/\square''$

$E = \frac{11030}{10850} = 101\%$

Sixth Floor.

$S = 110790^{\#}$

Assume $3\frac{1}{2}'' \times 2\frac{1}{2}'' \times \frac{1}{4}''$ Ls and $7'' \times \frac{1}{4}''$ Pl- $\quad l = 132''$

$A = 7.5\square'' \quad r = 1.49 \quad \frac{l}{r} = \frac{132}{1.49} = 88.6$

Al. $S = 12000^{\#}$

$S = \frac{110790}{7.5} = 11890^{\#}$

$E = \frac{12000}{11890} = 101\%$

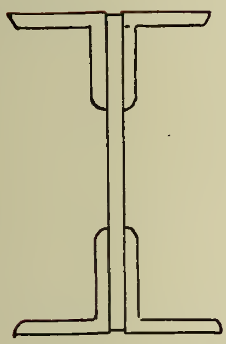
It is unnecessary to go further into the design, as the following floors are designed in the same manner as shown above.

EXAMPLES OF METHODS OF DESIGNING COLMNS

LOAD ECCENTRIC
COLUMN-19

Roof.

Direct S = 1800#
Eccen. S. = 38400#
$l = 4'-0'' = 48''$



Assume $3\frac{1}{2}'' \times 2\frac{1}{2}'' \times \frac{5}{16}''$ Ls and $7'' \times \frac{5}{16}''$ Plate
$A = 9.3\square''$ $r = 1.49$ $I = 76.2$
$\frac{l}{r} < 90 \therefore$ All $S = 12000\#$

$$S = \frac{40200}{9.3} + \frac{38400 \times 3.625 \times 3.625}{76.2 - \frac{38400 \times 2314}{3(10)^8}} = 4330 + 6670 = 11000\ \#/\square''$$

$$E = \frac{12000}{11000} = 109\%$$

Eighth floor.

Direct S. = 50200#
Eccen. S. = 9600#
$l = 11'-0'' = 132''$

All. S. = 12000#/□"
Assume section as above

$$S = \frac{59800}{9.3} + \frac{9600 \times 3.625 \times 3.625}{76.2 - \frac{9600 \times 17430}{3(10)^8}} = 6450 + 1770 = 8220$$

$$E = \frac{12000}{8220} = 146\%$$

The above examples are sufficient to show the general method of design of eccentrically loaded Columns.

Column Schedule

<table>
<tr><th rowspan="2">Floor</th><th colspan="17">Column Number</th></tr>
<tr><th>18</th><th>19</th><th>20</th><th>21</th><th>22</th><th>23</th><th>24</th><th>25</th><th>26</th><th>27</th><th>28</th><th>29</th><th>30</th><th>31</th><th>32</th><th>33</th><th>34</th></tr>
<tr><td>Roof</td>
<td rowspan="3">3"x2½"x¼" Ls
6"x¼" Pl.</td>
<td rowspan="2">3"x2½"x¼" Ls
6"x¼" Pl.</td>
<td rowspan="3">3½"x2½"x¼" Ls
7"x¼" Pl.</td>
<td rowspan="2">3"x2½"x¼" Ls
6"x¼" Pl.</td>
<td rowspan="3">3½"x2½"x¼" Ls
7"x¼" Pl.</td>
<td rowspan="2">3"x2½"x¼" Ls
6"x¼" Pl.</td>
<td rowspan="3">3"x2½"x¼" Ls
6"x¼" Pl.</td>
<td rowspan="2">3"x2½"x¼" Ls
6"x¼" Pl.</td>
<td rowspan="3">5"x3½"x⅜" Ls
10"x⅜" Pl.</td>
<td rowspan="2">3"x2½"x¼" Ls
6"x¼" Pl.</td>
<td rowspan="3">3½"x2½"x¼" Ls
7"x¼" Pl.</td>
<td rowspan="2">3"x2½"x¼" Ls
6"x¼" Pl.</td>
<td rowspan="3">3½"x2½"x¼" Ls
7"x¼" Pl.</td>
<td rowspan="4">3" x2½" x¼" Ls
6"x¼" Pl.</td>
<td rowspan="3">3½"x2½"x¼" Ls
6"x¼" Pl.</td>
<td rowspan="2">3"x2½"x¼" Ls
6"x¼" Pl.</td>
<td rowspan="3">3½"x2½"x¼" Ls
6"x¼" Pl.</td>
</tr>
<tr><td>8th</td></tr>
<tr><td>7th</td>
<td rowspan="2">3½"x2½"x5/16" Ls
8"x5/16" Pl.</td>
<td rowspan="2">4"x3"x5/16" Ls
8"x5/16" Pl.</td>
<td rowspan="2">3½"x2½"x5/16" Ls
8"x5/16" Pl.</td>
<td rowspan="2">3½"x2½"x¼" Ls
7"x¼" Pl.</td>
<td rowspan="2">3½"x2½"x5/16" Ls
8"x5/16" Pl.</td>
<td rowspan="2">4"x3"x5/16" Ls
8"x5/16" Pl.</td>
<td rowspan="2">3½"x2½"x¼" Ls
7"x¼" Pl.</td>
</tr>
<tr><td>6th</td>
<td rowspan="2">3"x2½"x¼" Ls
7"x¼" Pl.</td>
<td rowspan="2">5"x3½"x5/16" Ls
10"x5/16" Pl.</td>
<td rowspan="2">4"x3"x⅜" Ls
8"x⅜" Pl.</td>
<td rowspan="2">4"x3"x⅜" Ls
8"x⅜" Pl.</td>
<td rowspan="2">5"x3½"x⅜" Ls
10"x⅜" Pl.</td>
<td rowspan="2">4"x3"x⅜" Ls
8"x⅜" Pl.</td>
<td rowspan="2">4"x3"x⅜" Ls
8"x⅜" Pl.</td>
<td rowspan="2">4"x3"x5/16" Ls
8"x5/16" Pl.</td>
<td rowspan="2">3½"x2½"x¼" Ls
8"x¼" Pl.</td>
</tr>
<tr><td>5th</td>
<td rowspan="2">4"x3"x⅜" Ls
8"x⅜" Pl.</td>
<td rowspan="2">4"x3"x7/16" Ls
8"x7/16" Pl.</td>
<td rowspan="2">5"x3½"x⅜" Ls
10"x⅜" Pl.</td>
<td rowspan="2">5"x3½"x⅜" Ls
10"x⅜" Pl.</td>
<td rowspan="2">4"x3"x⅜" Ls
8"x⅜" Pl.</td>
<td rowspan="2">4"x3"x7/16" Ls
8"x7/16" Pl.</td>
<td rowspan="2">3½"x2½"x5/16" Ls
7"x5/16" Pl.</td>
<td rowspan="2">4"x3"x⅜" Ls
8"x⅜" Pl.</td>
</tr>
<tr><td>4th</td>
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10"x5/16" Pl.</td>
<td rowspan="2">6"x3½"x7/16" Ls
12"x7/16" Pl.</td>
<td rowspan="2">5"x3½"x⅜" Ls
12"x⅜" Pl.</td>
<td rowspan="2">5"x3½"x7/16" Ls
10"x7/16" Pl.</td>
<td rowspan="2">5"x3½"x⅜" Ls
12"x⅜" Pl.</td>
<td rowspan="2">6"x3½"x7/16" Ls
12"x7/16" Pl.</td>
<td rowspan="2">5"x3½"x⅜" Ls
10"x⅜" Pl.</td>
<td rowspan="2">4"x3"x⅜" Ls
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8"x⅜" Pl.</td>
</tr>
<tr><td>3rd</td>
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12"x7/16" Pl.</td>
<td rowspan="2">6"x3½"x⅜" Ls
12"x⅜" Pl.</td>
<td rowspan="2">6"x3½"x7/16" Ls
12"x7/16" Pl.</td>
<td rowspan="2">5"x3½"x⅜" Ls
10"x⅜" Pl.</td>
<td rowspan="2">5"x3½"x7/16" Ls
12"x7/16" Pl.</td>
<td rowspan="2">4"x3"x5/16" Ls
10"x5/16" Pl.</td>
<td rowspan="2">5"x3½"x7/16" Ls
10"x7/16" Pl.</td>
</tr>
<tr><td>2nd</td>
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12"x⅜" Pl.</td>
<td rowspan="3">6"x3½"x⅝" Ls
12"x⅝" Pl.</td>
<td rowspan="3">6"x3½"x9/16" Ls
12"x9/16" Pl.</td>
<td rowspan="3">6"x3½"x9/16" Ls
12"x9/16" Pl.</td>
<td rowspan="3">6"x3½"x½" Ls
12"x½" Pl.</td>
<td rowspan="3">6"x3½"x⅝" Ls
12"x⅝" Pl.</td>
<td rowspan="3">6"x3½"x9/16" Ls
12"x9/16" Pl.</td>
<td rowspan="3">6"x3½"x9/16" Ls
12"x9/16" Pl.</td>
<td rowspan="3">6"x3½"x⅜" Ls
12"x⅜" Pl.</td>
</tr>
<tr><td>1st</td>
<td rowspan="2">6"x3½"x7/16" Ls
12"x7/16" Pl.</td>
<td rowspan="2">6"x3½"x9/16" Ls
12"x9/16" Pl.</td>
<td rowspan="2">6"x3½"x9/16" Ls
12"x9/16" Pl.</td>
<td rowspan="2">6"x3½"x9/16" Ls
12"x9/16" Pl.</td>
<td rowspan="2">6"x3½"x7/16" Ls
12"x7/16" Pl.</td>
<td rowspan="2">6"x3½"x9/16" Ls
12"x9/16" Pl.</td>
<td rowspan="2">6"x3½"x9/16" Ls
12"x9/16" Pl.</td>
<td rowspan="2">6"x3½"x½" Ls
12"x½" Pl.</td>
</tr>
<tr><td>Basement</td></tr>
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COLUMN SCHEDULE

<table>
<tr><th rowspan="2">Column Number</th><th colspan="10">Floor</th></tr>
<tr><th>Basement</th><th>1st.</th><th>2nd</th><th>3rd</th><th>4th</th><th>5th</th><th>6th</th><th>7th</th><th>8th</th><th>Roof</th></tr>
<tr><td>1</td><td colspan="2">6"x3½"x9/16" Ls
12"x9/16" Pl.</td><td colspan="2">4"x3"x5/16" Ls
10"x5/16" Pl.</td><td colspan="2">3½"x2½"x¼" Ls
7"x¼" Pl.</td><td colspan="3">3"x2½"x¼" Ls
6"x¼" Pl.</td><td></td></tr>
<tr><td>2</td><td colspan="3">6"x3½"x9/16" Ls
12"x9/16" Pl</td><td colspan="2">4"x3"x3/8" Ls
10x3/8" Pl.</td><td colspan="2">4"x3"x5/16" Ls
8"x5/16" Pl.</td><td colspan="3">3½"x2½"x¼" Ls
6"x¼" Pl.</td></tr>
<tr><td>3</td><td colspan="2">6"x3½"x9/16" Ls
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10"x3/8" Pl.</td><td colspan="2">4"x3"x5/16" Ls
10"x5/16" Pl.</td><td colspan="2">3½"x2½"x¼" Ls
7"x¼" Pl.</td><td colspan="2">3"x2½"x¼" Ls
6"x¼" Pl.</td></tr>
<tr><td>4</td><td colspan="3">6"x3½"x9/16" Ls
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10"x3/8" Pl.</td><td colspan="2">4"x3"x5/16" Ls
8"x5/16" Pl</td><td colspan="3">3"x2½"x¼" Ls
6"x¼" Pl.</td></tr>
<tr><td>5</td><td colspan="2">6"x3½"x7/16" Ls
12"x9/16" Pl.</td><td colspan="2">5"x3½"x3/8" Ls
10"x3/8"</td><td colspan="2">4"x3"x5/16" Ls
10"x5/16" Pl</td><td colspan="2">3½"x2½"x¼" Ls
7"x¼" Pl</td><td colspan="2">3"x2½"x¼" Ls
6"x¼" Pl.</td></tr>
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10"x5/16" Pl</td><td colspan="2">3½"x2½"x¼" Ls
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6"x¼" Pl.</td></tr>
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12"x7/16" Pl</td><td colspan="2">5"x3"x3/8" Ls
10"x3/8" Pl.</td><td colspan="2">4"x3"x5/16" Ls
8"x5/16" Pl.</td><td colspan="2">3"x2½"x¼" Ls
6"x¼" Pl.</td></tr>
<tr><td>8</td><td colspan="3">6"x3½"x9/16" Ls
12"x9/16" Pl</td><td colspan="2">5"x3½"x7/16" Ls
10"x7/16" Pl.</td><td colspan="2">4"x3"x3/8" Ls
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6"x¼" Pl.</td></tr>
<tr><td>9</td><td colspan="2">6"x3½"x9/16" Ls
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8"x7/16" Pl.</td><td colspan="2">4"x3"x5/16" Pl.
8"x5/16" Pl.</td><td colspan="2">3"x2½"x¼" Ls
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10x7/16" Pl.</td><td colspan="2">4"x3"x3/8" Ls
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6"x¼" Pl.</td></tr>
<tr><td>11</td><td colspan="2">6"x3½"x9/16" Ls
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8"x7/16" Pl.</td><td colspan="2">4"x3"x5/16" Ls
8"x5/16" Pl.</td><td colspan="2">3½"x2½"x¼" Ls
6"x¼" Pl.</td></tr>
<tr><td>12</td><td colspan="3">6"x3½"x9/16" Ls
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12"x3/8" Pl.</td><td colspan="2">4"x3"x3/8" Ls
8"x3/8" Pl.</td><td colspan="3">3½"x2½"x¼" Ls
7"x¼" Pl.</td></tr>
<tr><td>13</td><td colspan="2">6"x3½"x9/16" Ls
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12"x3/8" Pl.</td><td colspan="2">5"x3½"x3/8" Ls
10"x3/8" Pl.</td><td colspan="2">3½"x2½"x5/16" Ls
8"x5/16" Pl</td><td colspan="2">3"x2½"x¼" Ls
6"x¼" Pl.</td></tr>
<tr><td>14</td><td colspan="3">6"x3½"x9/16" Ls
12"x9/16" Pl.</td><td colspan="2">5"x3½"x7/16" Ls
10"x7/16" Pl.</td><td colspan="2">4"x3"x3/8" Ls
8"x3/8" Pl</td><td colspan="3">3"x2½"x¼" Ls
6"x¼" Pl.</td></tr>
<tr><td>15</td><td colspan="2">6"x3½"x9/16" Ls
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12"x7/16" Pl.</td><td colspan="2">4"x3"x7/16" Ls
8"x7/16" Pl.</td><td colspan="2">4"x3"x5/16" Ls
8"x5/16" Pl.</td><td colspan="2">3"x2½"x¼" Ls
6"x¼" Pl.</td></tr>
<tr><td>16</td><td colspan="3">6"x3½"x5/8" Ls
14"x5/8" Pl.</td><td colspan="2">6"x3½"x7/16" Ls
12"x7/16" Pl.</td><td colspan="2">5"x3½"x5/16" Ls
10"x5/16" Pl.</td><td colspan="3">3½"x2½"x¼" Ls
7"x¼" Pl.</td></tr>
<tr><td>17</td><td colspan="2">6"x3½"x9/16" Ls
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10"x3/8" Pl.</td><td colspan="2">4"x3"x5/16" Ls
10"x5/16" Pl.</td><td colspan="2">3½"x2½"x¼" Ls
7"x¼" Pl.</td><td colspan="2">3"x2½"x¼" Ls
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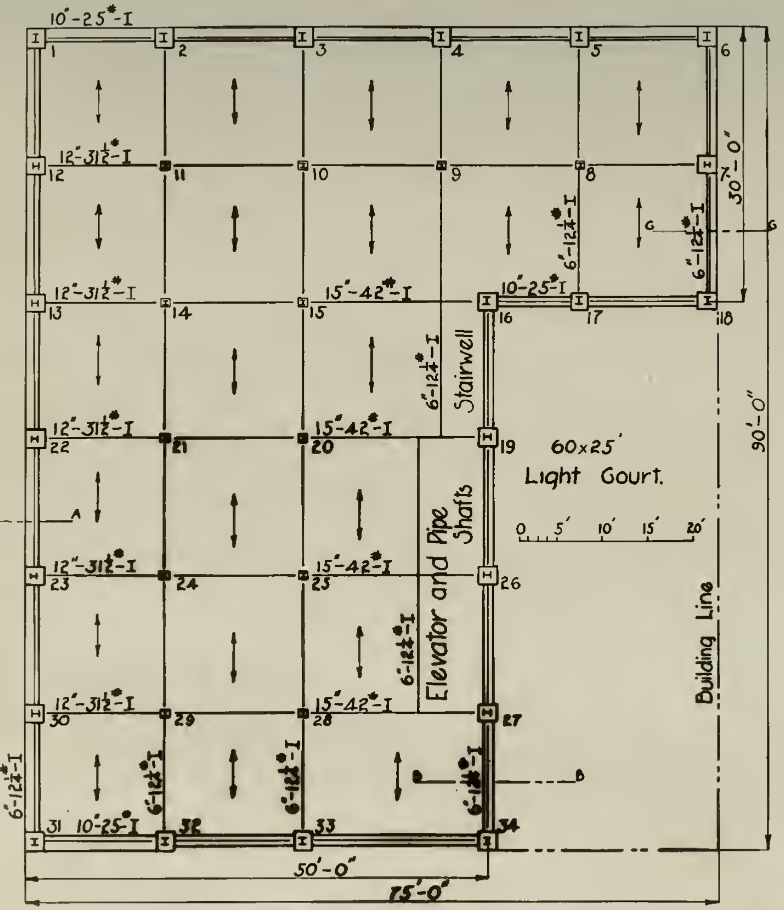
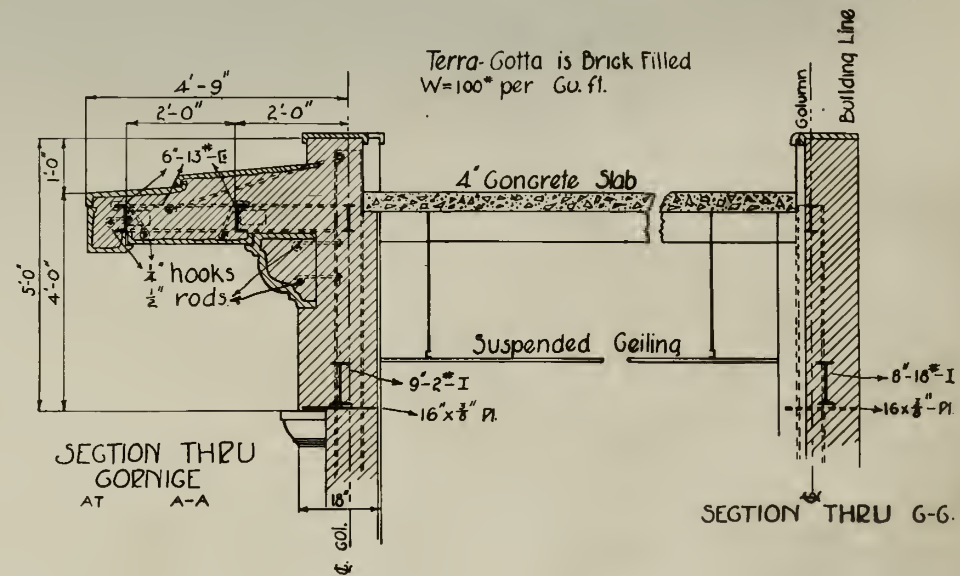
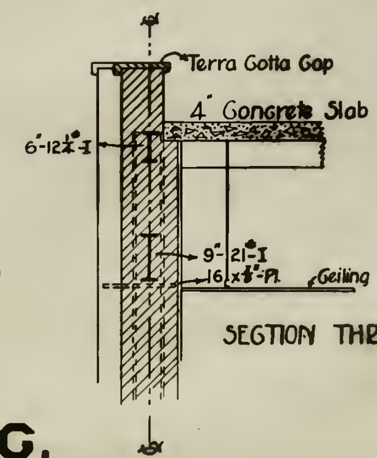


ROOF FRAMING PLAN.



SECTION THRU CORNICE AT A-A

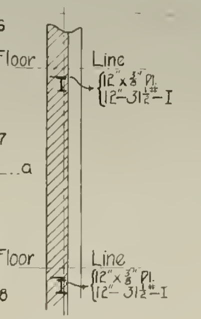
SECTION THRU G-G.



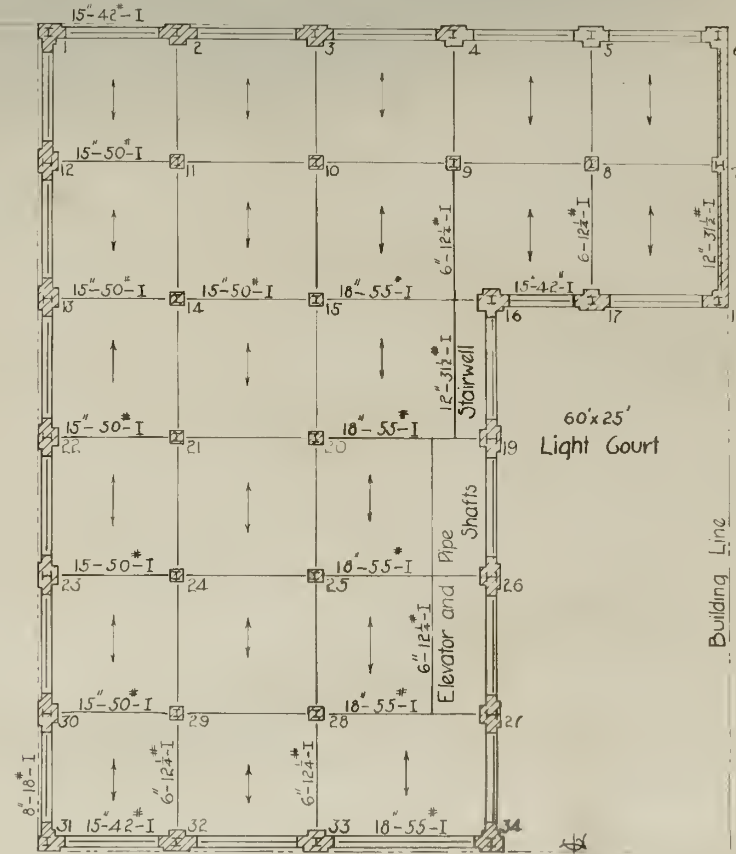
SECTION THRU B-B.

DESIGN
OF AN
EIGHT STORY
OFFICE BUILDING.
DESIGNED BY P.L.GRADY.
UNIVERSITY OF ILLINOIS 1908.

Typical Floor Framing Plan.



Section thru a-a



DESIGN
OF AN
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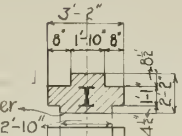
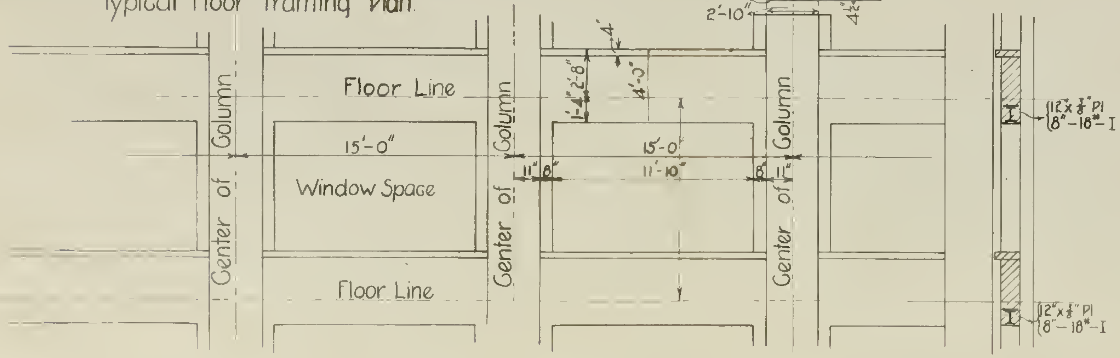
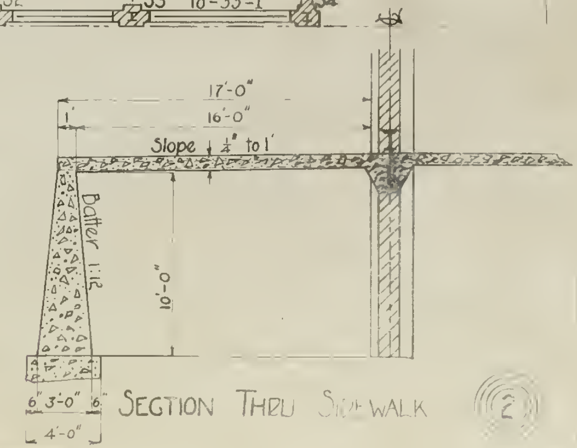
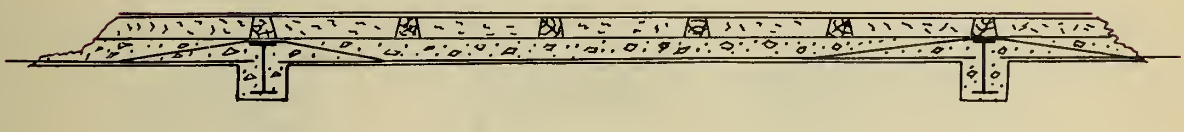




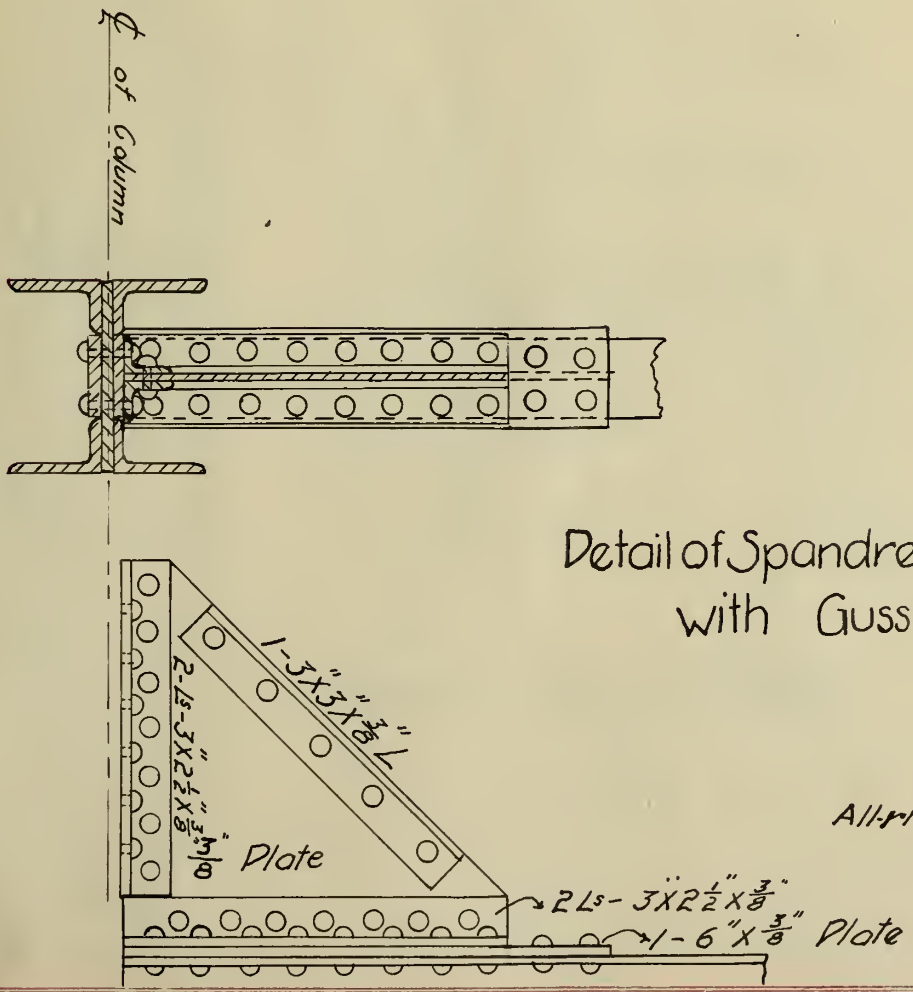
Typical Spandrel Wall



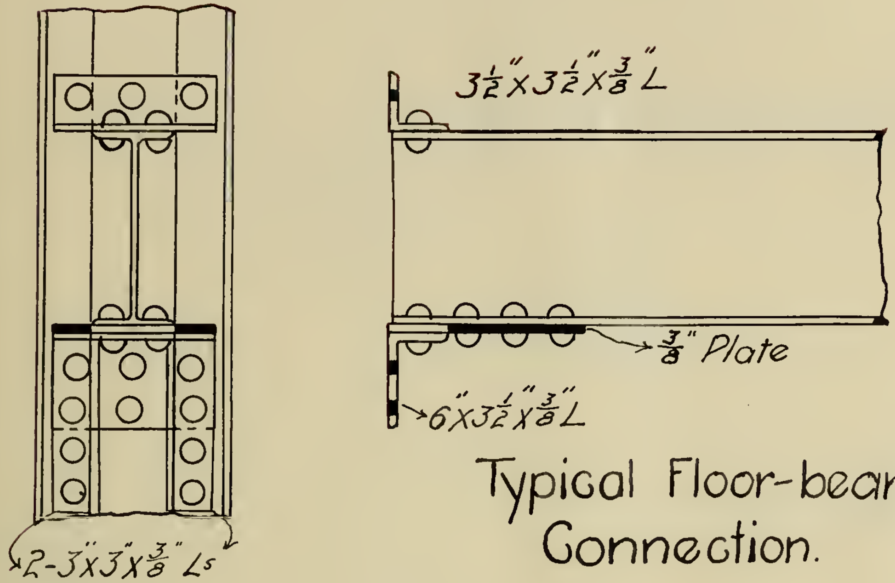
Section Thru Sidewalk



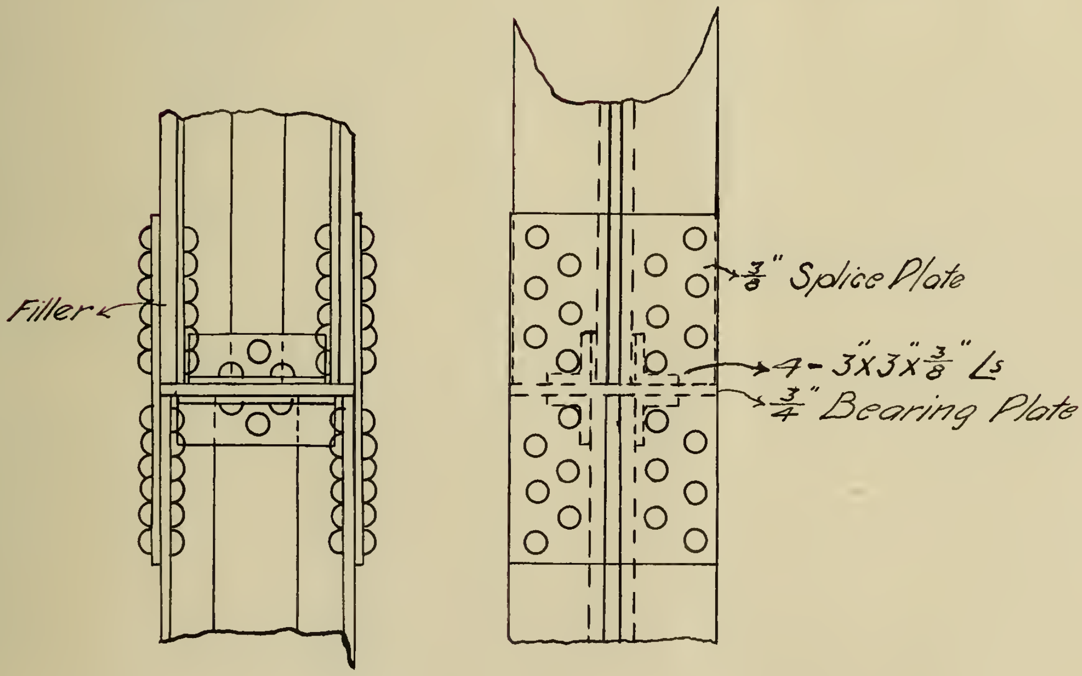
Section thru typical floor-slab
Showing reinforcement



Detail of Spandrel beam
with Gussets



Typical Floor-beam Connection.



Typical Column Splice